Final Synopsis
of the thesis titled

# GEOCHEMICAL AND MINERALOGICAL STUDIES OF SURFICIAL AND DEEP MARINE SEDIMENTS THROUGH THE TRANSECT FROM MANGALORE TO KARWAR, KARNATAKA, INDIA

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## MARINE GEOLOGY

by

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# Introduction

Marine sediments are derived from different terrigenous (land-derived) sediment sources and often generated in the ocean water column itself (hydrogenous), through biological activity (biogenic) and generated in-situ (authigenic), etc. The relative proportions of in these sediments vary temporally as well as spatially in the ocean. In this study, textural, clay mineralogical and geochemical studies have been carried out on marine sediments along the nearshore and deeper water along the central west coast India.

# The brief outline of the thesis is given below:

The thesis is divided into Introduction, Materials and Methods, Results and Discussion, Conclusions and References. This first chapter describes about general introduction, review of literature, background information about the western continental margin, hinterland of the study area, scope and objectives.

The main objectives of the study were to determine the sources of nearshore and open ocean sediments along the south-western continental margin of India, particularly Mangalore-Karwar sector through particle size, clay mineralogical and geochemical studies. Further, each sub-set of nearshore and open ocean sediment samples have been studied in detail to delineate oceanographic and geochemical and mineralogical processes operating in the area of investigation. This study also provides the information related to biological productivity, geochemical and mineralogical processes operating in the sedimentary column and the possible impact of human activity on the marine environment. The voluminous data gathered through this investigation have been subjected to statistical analyses such as computation of correlation coefficients and R-

Mode factor analyses to simplify the biogeochemical processes taking place in the nearshore and open ocean environments.

Surface sediment samples from estuarine and coastal regions (10-15 m water depth) were collected from Peterson grab sampler, while open ocean sediments along Karwar, Kundapur and Mangaore were collected at water depths of 1440, 1080 and 1192 by using gravity corer. Samples were sub-sampled, dried and processed for particle size analysis, clay mineral identification by XRD, and major and geochemical analyses by ICP-MS as per the usual standard procedures.

## The main salient features particle size, clay mineralogical and geochemical study of nearshore and Open Ocean sediments are given below:

The estuarine and nearshore sediments are characterized by the abundance of sand fraction followed by silt then clay. The most abundant mineral is the kaolinite, followed by illite, smectite, chlorite and gibbsite due to the influence of humid climate prevailing over the study area. The element enrichment factors of sediments have been studied to reduce the scatter distributions as a result of particle size variations. The element enrichment factors (EFs) of Mg, K, Na and Ba of the estuarine and coastal sediments are lower when compared to global river suspended particulate matter (GRSPM) shallow water sediment (SWS) and global mean sediment (GMS) indicating the sediments of the study area have been derived from an intense chemically weathered hinterland terrain. However, Mn, Sc, V, Cr, Co and Ni are higher in the former case than the latter due to the transport of heavy minerals from the hinterland through rivers. The EFs of Cu, Zn and Pb for the sediments of the study area are lower when compared to those for the global river suspended matter, however, higher

as compared to the averages of mean sediments and shallow water sediments suggesting that the sediments are not much contaminated.

The open ocean sediments of the study area are different from those for estuarine and nearshore counterparts in terms of sediment texture (particle size), clay mineralogy as well as geochemistry. R-mode factor analysis compliments this delineation as there are six factors identified for nearshore sediments, whereas 10-11 for the open ocean sediments. The sand is least abundant fraction in the open ocean sediments of the study area, while the silt is most abundant fraction in sediments off Karwar and Kundapur sectors, while clay fraction the in sediments off Mangalore.

The dominant clay minerals in the open ocean sediments are illite, smectite and to some extent chlorite. In contrast, kaolinite is the most abundant mineral in the sediments of the nearshore that actually ranks third in open ocean sediments. This clearly suggests that an additional source of sediments for the open ocean. Occurrence of illite, chlorite and smectite in the open ocean sediments of the study area indicates that these clay minerals are derived from the weathering of Himalayas and Deccan basaltic provinces of south Asia, transported through the major Rivers such as Ganges and Brahmaputra, and Indus, Narmada and Tapti, to the Bay of Bengal and Arabian Sea respectively, and dispersed to the study area by the west Indian coastal currents (WICC).

The EFs of Ca, K and Na for the open ocean sediments off Karwar, Kundapur and Mangalore are higher by factors of 5 to 15, whereas Zr and Mg are considerably lower by factors of 4 to 6 as compared to those for the estuarine and nearshore sediments of the study area. This is because of mixing of sediments brought from the major rivers such as Indus, Narmada and Tapti, and to some extent with Ganges and Brahmaputra with those brought from the hinterland rivers. In contrast, the EFs of Sc, V, Cr, Co

and Ni are higher by factors of 1.7 to 4.4 for estuarine nearshore sediments than those for the open ocean, suggesting that heavy minerals lag behind during the offshore transport of sediments.

R-mode factor analysis of particle size, clay mineralogical and geochemical data suggest that the open ocean sediments off Karwar, Kundapur and Mangalore are quite homogeneous, however, they are distinct from the nearshore region of the study area. The most abundant factor is the terrigenous that can be distinguished as that derived from sediment brought from the hinterland, Himalayan catchment as well as Deccan basaltic province. Biogenic factor are next to the terrigenous sediment that can be distinguished as organic carbon and calcium carbonate. In addition, adsorbed trace metals and coarse textured sediment fraction identified.

Thus this study concludes that the sediments deposited in the estuarine and nearshore waters are quite different from those deposited in the open ocean along the western continental margin of India, suggesting an additional source of terrigenous sediment traced from major rivers such as, Indus, Narmada and Tapti, Ganges and Brahmaputra draining the South Asia.

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